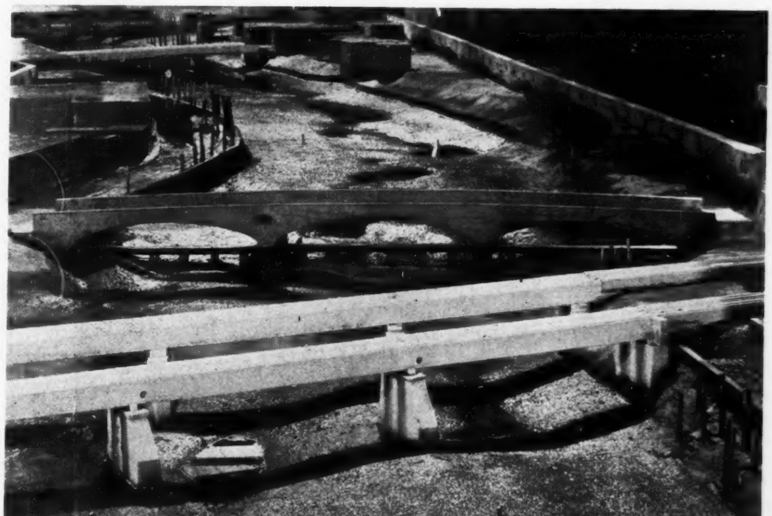
The CORNELL ENGINEER



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The Technical School Prepares for Industrial Marketing

By Prof. J. R. Bangs Jr. and Ass't Prof. H. J. Loberg

Volume 3 NOVEMBER, 1937 Number 2

THE CORNELL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR

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COMMENTS

Our cover is a recent picture of the model being used for tests to study flood control in the Chenango River Valley by the U. S. Army Engineer's Office at Cornell.

Professors Bangs and Loberg give us a comprehensive analysis of Industrial Engineering as treated in the more advanced technical schools.

Mr. Mohr of the U. S. Army Engineer's Office explains the present project being investigated for the creation of an adequate flood control for the southern tier of New York State.

Bill Mills relates the interesting development of Molybdenum from the research stage to its present strategic position in the commercial field.

We present Dr. Edmund Ezra Day, new President of the University, in a letter of greeting to the Engineering College. Also a description of the inaugural proceedings of October 8, 1937.

Be sure to read the Constitution and By-Laws of the Cornell Society of Engineers following the letter from the Society's President.

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—Courtesy Electronics

Vacuum Tubes for High Power Transmission

The CORNELL ENGINEER

Volume III November, 1937 No. 2

The Technical School Prepares for Industrial Marketing

J. R. BANGS, JR. *Professor Administrative Engineering* H. J. LOBERG *Ass't. Professor Administrative Engineering*

EDITOR'S NOTE: The material in this article was presented by the authors under the auspices of *The Committee on Industrial Engineering of The Society for the Promotion of Engineering Education* at Cambridge, Massachusetts, June 30, 1937.

Just as Industrial Engineering was gradually projecting itself into the Mechanical Engineering curricula of this country during the period 1908-1915, so today a relatively new subject—Industrial Marketing—is slowly but surely winning recognition among engineering educators. Apropos of this idea is an editorial which appeared in the May 1936 issue of *Industrial Marketing*. This editorial begins by saying that Gerard Swope, the President of the General Electric Company, had recently suggested that most engineering courses were too narrow. It goes on to develop the idea that one way to broaden them is to include instruction in the broad principles of marketing, and especially industrial marketing, in engineering schools. In conclusion it reads: "Here is an avenue for greater usefulness for the engineering school. We realize that most courses are already crowded and that there is a constant demand for the addition of new studies; but we believe that a survey of the field among manufacturers and among graduates will demonstrate the fact that a reasonably thorough course in Industrial Marketing would be a valuable addition to the curricula of most engineering schools."

This editorial served a useful purpose for it caused many schools to critically appraise their curricula. The members of the eleven colleges and universities, who replied in the June and July issues, showed that well established teaching programs in Marketing and Industrial Marketing, were under way in some institutions, and that other institutions were in the process of forming such courses.

To some of you who have not seriously thought of this field, the question no doubt arises: "Just what is marketing?" A widely accepted definition states that "marketing is the process of conveying goods through commercial channels from the producer to the consumer." It includes a gamut of activities such as Market Research, Product Development, Channels of Distribution, Sales Organization, Advertising and other functions which are so vitally necessary in the process of satisfying the wants of the consumer.

Perhaps an actual illustration will serve to make my meaning clear, and also to emphasize the value of modern marketing. This story begins in the fall of 1928. At that time Mr. John Doe, president and principal owner of a successful and flourishing business established by his grandfather, had returned from a four months' vacation in Europe. His firm, located in the Middle West, manufactured coal ranges, gas ranges, and heaters. The business had prospered. Buildings and goodwill represented accrued wealth of about two million dollars. Quite naturally he felt secure and satisfied with his life's work. This sense of well being, however, was destined to be short lived. The economic hurricane which broke in 1929, and drove and lashed with fury in 1930, 1931 and 1932, caused several very embarrassing things to happen to Mr. Doe's organization.

In 1929 it became necessary to call in the investment banker. The crash brought things to a focus. The next preferred dividend was met partly from surplus with a calm assurance, which faded, however, when the next two had to be passed. With affairs in this crucial state, sales doing a tail spin, and loans frozen solid, the banks stepped in.

During the first half of 1932, Mr. Doe and his assistants ran the business; during the second half, representatives of the bank were behind the controls. Their joint efforts resulted in a total sales figure of $268,000 which resulted in a loss of $324,000—an actual deficit of $56,000 more than the sales figures.

Toward the end of the year, marketing counsellors were brought in to make a market analysis to meet this desperate situation. This analysis revealed that

the market had shrunk, but not in the drastic proportion indicated by the sales figures of the Doe organization. It also showed that a preference had developed for cheaper merchandise, whereas this manufacturer had for seventy-five years made quality high price units.

The study continued. Territories were broken down county by county, and analyzed as to their potential sales capacities. The product was studied from every angle—from construction, from style, from operating cost, from all possible buying motives. Competitive units were studied with the same care; selling time and effort were carefully scrutinized, and a reasonable profit aim was incorporated into a system of planned sales control.

Because of these efforts the tide turned slowly but steadily. In 1933, sales increased by $187,000 but the loss of $324,000 of the previous year turned into a profit of $78,000. And, 1934 proved even better with sales at $1,100,000 and profits at $202,000. In the meantime, sales expense had dropped from 23.9% in 1932 to 9.9% in 1933 and finally to 7.4% in 1934.

To the uninitiated this may sound ilke legerdemain, but I assure you it was not. The successful, if not altogether happy ending was the fruit of a thorough appraisal of the market and a plan of sales control made to fit it. It is significant that the factual approach of engineering was used by the marketing counsellors who installed this plan, for both of them are trained engineers—men of the type that engineering schools are seeking to train today.

Course Content

Industrial Marketing, you know, deals largely with the products of engineering—coal, steel, engines, boilers, machine tools, etc.—"commodities which are converted into other forms or which are consumed in the production or distribution of other goods or services."

The content of a course in Industrial Marketing will vary with a number of different factors—time, material, faculty personnel, etc. For a three-hour credit course, the following topical list is suggested:

1. Market Research.
2. Product and Product Development.
3. Channels of Distribution.
4. Sales Organization.
5. Sales Management.
6. Sales Planning.
7. Sales Control.
8. Sales Compensation.
9. Pricing and Credit.
10. Service Features.
11. Advertising.
12. Sales Promotion.

Case Material

In the development of our own courses at Cornell, we have been most fortunate in obtaining case material from many outside agencies, and have frequently had the honor of having the heads of such organizations speak to our students as non-resident lecturers.

Market Research

In order that you may evaluate the nature of case material, I shall take several topics from my outline and illustrate them with material gathered in the process of developing our own courses. You will appreciate, of course, that time permits me to give you only the high spots in story form.

First, I shall illustrate market research, or in this particular instance, just what the lack of it may lead to. A manufacturer of dough mixing machines for the bakery trade was reasonably successful. One day an inquiry was received for an ink mixing machine for printers; and since the technical and manufacturing problems of the two types of mixing machines were similar, an ink mixer could be manufactured to meet the desired specifications. But immediately the manufacturer became ambitious. Looking at the overall statistics of the printing industry, he found that there were 39,000 printers in the United States. And, he reasoned each of them was a potential purchaser of an ink mixing machine.

Based on this fallacious reasoning, the concern busied itself designing, tooling up, and getting ready for this new market. They gave little heed to the problems of selling; they took them for granted until someone discovered that the 39,000 printers were not, and could not, be potential customers. This was true because only those who used the four-color process required such a mixer. The apparent market for this reason shrunk overnight—not because of a new method or any other technological reason—but only because the manufacturer did not have the true facts and all the facts about the potential product when he plunged into manufacture. A more careful study would have altered his policies, his view of the market, his method of profitably reaching that market, and possibly the product itself.

While this experience was a rather costly lesson to our manufacturing friend, it did not deter him from taking one more plunge. When an order for a paint mixer was received, he more or less repeated his previous performance. This time the requirements of the makers of varnishes, shellac, certain quick-drying enamels, etc. were completely ignored and several very costly mistakes made. After a forced financial reorganization, he sought marketing counsel which enabled him to develop a new program. This program included both the ink and paint mixers, but on a dif-

ferent basis, with a final net result of satisfactory volume at a reasonable profit. I have not given you all of the details, of course, but I believe you can readily appreciate that this case illustrates a complete lack of market research and the consequences that follow. Only too often are the mistakes made by this manufacturer repeated in the everyday operations of industry.*

Product and Product Development

Next let us consider product and product development. In this field, illustrations are legion in number. Product engineering has been one of the outstanding developments of the depression, and the trend towards diversification has been so pronounced in the last decade that the problem of developing new products, revamping old ones, and broadening existing markets has gained new significance. There are many illustrations. Libbey-Owens-Ford Glass Company, for example, has recently developed a new tempered glass known as "Tuf-Flex" which can be twisted or bent amazingly, and has great resistance to thermal shock and impact. Such glass is about to create a new industry—the manufacture of all-glass furniture—and also is the basis for a new development known as "luminous architecture." The story of DuPont diversification runs from powder to paint to rayon to cellophane to plastics. A trolley bus and street car builder is preparing to market an automatic cotton picker, while Caterpillar Tractor Company is marketing commercially a diesel engine which they had developed for their own use. And so in breath-taking panorama, the march of new products rushes on.

In the early days of our own course development, we came across a rather unusual case. I frequently refer to it as the "Pan Washer" case. It illustrates not only product development, but market research as well. In this instance a manufacturer of special equipment and repair parts for the glass industry was faced, in 1932, with a steadily declining market. His organization was excellent. A splendid physical plant consisting of a well equipped foundry and pattern shop, a machine and structural shop, and a welding shop was augmented by a well trained personnel to operate and manage it. All that he needed was something to manufacture that could be sold at a profit, and, remember, this was back in 1932 when pessimism was free for the asking and optimism a hidden quality.

With the aid of trained marketing engineers, studies were made to discover products that might fulfill these requirements. The procedure was of a text book variety. The figures of leading business statistical organizations were scanned and analyzed in an endeavor to find industries operating in the black. This was difficult; but the Federal Reserve figures indicated that the bakery industry was operating on the same level as the years 1923, 1924 and 1925. The National City Bank of New York reported that the profits of the industry were off only 16%; interviews with the bakery press and officials of leading units confirmed this view.

The survey which followed showed that 80% of the bread consumed in this country was bakery made, but that only 20% of the cake was bakery made. The profit margin was small on bread; but excellent on cake. The obvious inference was to increase the sale of cakes, but a major obstacle to this objective was the elimination of bakery taste.

Further investigation showed that the whole bakery field was becoming conscious of the need for better pan washing equipment. So, what could be more logical for our manufacturer to do than to design and build Pan Washers.

Preliminary design showed the feasibility of such equipment and, since its manufacture fitted in admirably with existing plant facilities and personnel, it seemed a worth-while venture. There was competition in the field, but the manufacturer had enough data on the requirements of the users, size of immediate market, etc., to make this undertaking a planned one rather than a haphazard one.

I shall have to skip many of the details of a complicated and interesting business situation, but I should like to reiterate that the case is a most helpful one in that it illustrates a number of pertinent points. First, the preliminary search for a suitable product for an existing physical plant; second, the design and development of such a product; third, a search into the market to determine its extent and permanence; and fourth, an examination of the marketing-selling problem.*

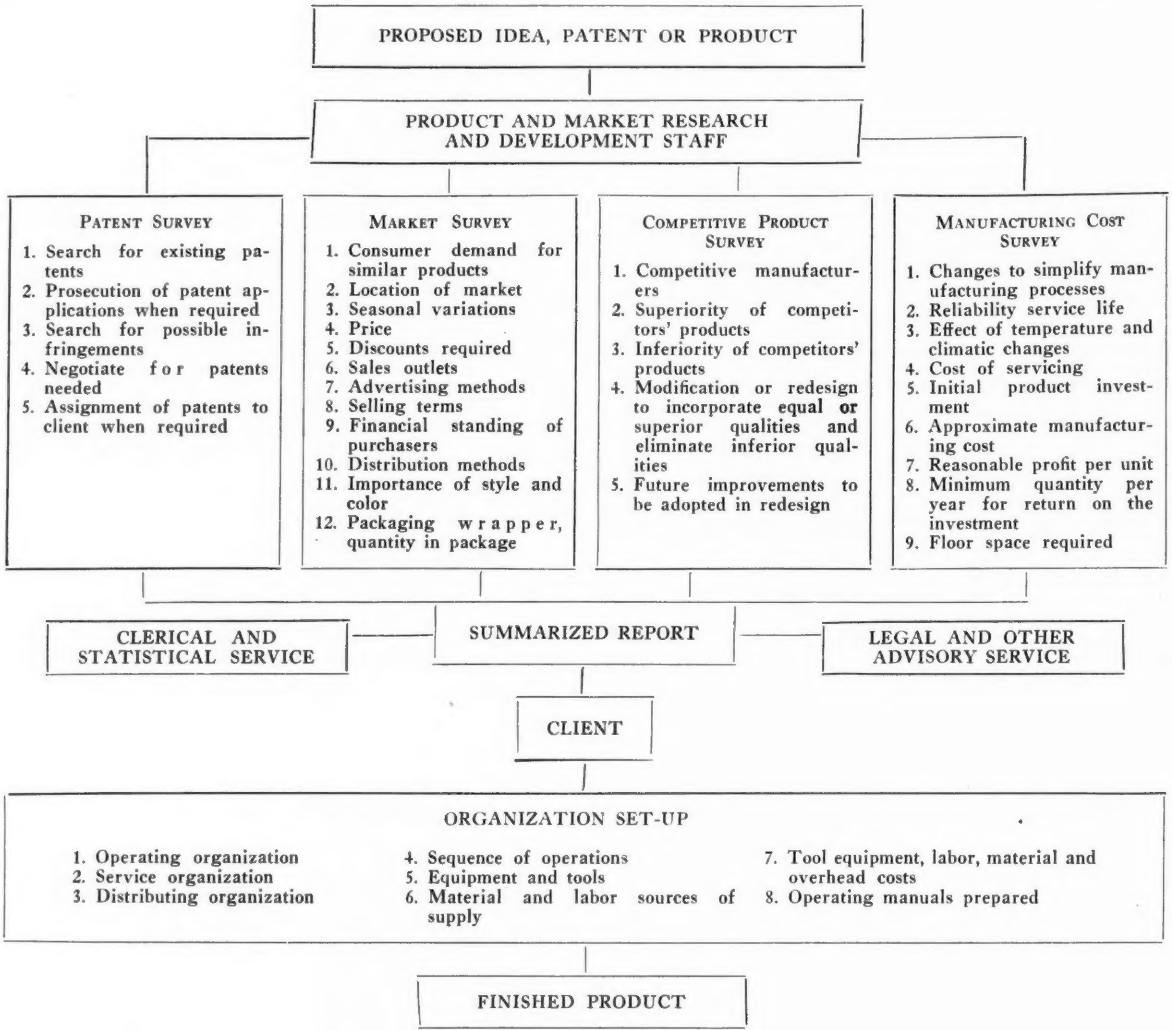
I am sorry that time prevents me from giving you further case illustrations. As the central theme of a discussion, cases are very helpful; for illustrative purposes, they are well nigh indispensible.

Relationship of Marketing To Industrial Engineering

In order to crystallize the close relationship between the fields of Industrial Engineering and Marketing, I would have you examine the diagram, "Steps in Product Development." This illustration, by John A. Honegger of Paterson, New Jersey, is reproduced by the courtesy of *Product Engineering*. As you see there are four surveys which should be made when a new product of a patentable nature is to be launched: (1) the patent survey, (2) the market survey, (3) the competitive product survey and (4) the manufacturing cost survey. I shall make no comment on

*Courtesy R. G. E. Ullman Company, Philadelphia, Pa.

STEPS IN PRODUCT DEVELOPMENT



"Developing a Product"—John A. Honegger, *Product Engineering*, August '34

the patent survey, since that falls strictly within the provinces of the patent attorney. The manufacturing cost survey deals with the work of the industrial engineer. It is the market survey, and the competitive product survey that I propose to go over with you more carefully, in view of their application to our present discussion on marketing.

The market survey, you will note, includes: (1) consumer demand for similar products, (2) location of markets, (3) seasonal variations, (4) price, (5) discounts required, (6) sales outlets, (7) advertising methods, (8) selling terms, (9) financial standing of purchasers, (10) distribution methods, and in the consumer field (11) the importance of style and color and (12) packaging, wrapper and quantity in package. This group is, more or less, a formal listing of the factors suggested in the two preceding cases, so I shall not elaborate upon them. It may be appropriate, however, to expand briefly upon advertising.

Industrial Advertising

Advertising is a vehicle for transmitting a sales message by methods other than those of personal salesmanship. It has aptly been compared to a modern production tool. Such a machine tool reduces the cost of manufacturing the product; and in a similar manner, advertising, properly used, reduces the cost of manufacturing the order. It may well be considered as an investment in a market, just as fixtures, tools

(*Continued on page fifty-three*)

Soils Mechanics In Flood Control

LAWRENCE G. MOHR, CE '30
U. S. Engineers' Office, Cornell University

After the disastrous floods of 1935 and 1936 throughout the southern tier of New York State, investigations were started as to means of preventing such occurrences in the future. Methods finally decided upon include river channel improvements and detention dams with uncontrolled outlets, with the latter forming the principal works. The system is similar in some respects to the Miami and Muskigum projects, with dams thrown across most of the important tributaries of the upper Susquehanna River, to control a large percentage of the drainage area.

In general the dams are to be designed so that the diversion conduit, after completion of the dam and spillway, will be reduced in diameter, leaving an opening large enough to pass only the daily average flow of the stream. The uncontrolled outlet then will hold back flows and present aggravation of an increased flow from any uncontrolled area; it will average out the daily flow of the stream and at the same time, keep pondage to a minimum.

The work was turned over to the U. S. Army Engineers, whose first task was to investigate the hydrology of the region and decide where improvement could be made, then to examine possible reservoir and channel improvement locations. After determining which of the examined locations were feasible, more detailed surveys are run to determine which will give the greatest benefit for the cost.

The North Atlantic Division, which included New England, New York, New Jersey and part of Pennsylvania, took direct charge of the work and a Flood Control Section was formed in the First New York District office, in New York City, to press progress of the work. By this time, it was seen that due to absence of suitable rock foundations, most of the dams would have to be of earth; Cornell University was selected as the site for the Foundation Investigation Section office as it was central to most of the dam sites and the opportunity would be present to turn problems demanding research over to civilian or Army Engineer graduate students.

As work progressed further, it was seen that the New York office was too far removed from the scene of operations; the Binghamton office became a District headquarters with charge of flood control work in the upper Susquehanna Valley, including Steuben (Hornell), Chemung (Elmira), Schuyler (Watkins Glen), Tompkins (Ithaca), Tioga (Owego), Cortland and Broome (Binghamton) counties and part of northern Pennsylvania.

The Foundaition Investigation Section at Ithaca is part of the Binghamton District. It has been engaged in testing soil samples from the several flood control dam sites and river channel improvements in the district and designing the earth structures and foundations on those sites. Additional investigations have been made for the First New York District for a yacht basin and approach in Flushing Bay for the New York's World Fair, and for an airport on the same vicinity.

Most of the investigation, however, has been conducted on two dam sites—Dam No. 8 on the Canisteo River at Arkport, above Hornell, and Dam No. 18, on the Otselic, at Whitney Point, a few miles from Binghamton.

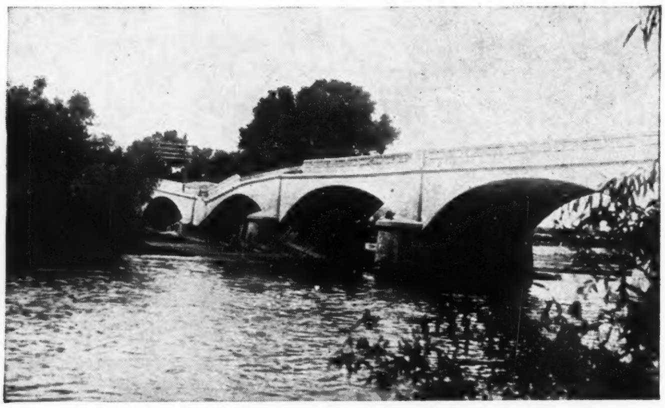
DESCRIPTION OF DAM SITES

Dam 8 is located at a construction of the channel just above the entrance of the Canisteo into the broad valley in which Hornell is situated. Glacial material damned the old pre-glacial valley and the stream was forced to seek its way out through a saddle in its right abutment. A nose of rock from this old wall forms the right abutment; remnants of this old wall and glacial fill form the left abutment.

The rock from the two sides continues across the present valley bottom, covered by only ten feet of a silty, gravelly sand overburden. This condition eliminates any foundation problem, although the cut-off trench in this material requires some attention to prevent excessive seepage, or even piping, under the dam.

The diversion conduit, later to be the uncontrolled outlet, has an 8′ round section tunnelled through the right abutment. A side channel spillway is also located on this abutment and leads to a bucket. According to design plans and barring accidental closure of the outlet, the spillway will function only once every 100 years.

Dam 18 has its left abutment on a hill with shallow



Bridge failure caused by pier settlement. A study of foundation material would have indicated lack of shearing resistance.

—COURTESY MC GRAW-HILL

overburden over sound rock. The rock however, drops off sharply in the valley, and under the dam itself, runs to a depth of about 50 feet. The right abutment is on one of a series of terraces of glacial outwash material; a dyke about a half-mile long runs back along the terrace to the required elevation; as this material is quite pervious, seepage here is important. However, the main problem of this site is one of foundations, as there are layers of clay and soft silt in the overburden under the dam proper.

The material excavated from the spillway and outlet cuts will be utilized for both pervious and impervious fill. No borrow area is contemplated, although material is available on the hill on the left.

Due to low normal flows in both streams and a lack of proper materials for hydraulic or semi-hydraulic fill dams, designs are being made for roll fill dams with cores compacted by sheepsfoot rollers.

Soil Mechanics Problems

After the location and nature of the dam have been determined from general considerations, the following soils mechanics problems arise:

A. Of the dam itself:
   1. What material and section to be used—a balance between stability, permeability and availability?
   2. How much seepage through the dam—any danger of piping?
   3. How much settlement in the dam—will it be high enough for design storage capacity after 100 per cent consolidation has occurred?
   4. What factor of safety for slope stability?
   5. What soil density and how to control?

B. Of the foundation:
   1. How much settlement.
   2. Strength in shear.
   3. Seepage through underground.

To get data to solve these problems, exploration and testing are necessary.

Field Methods

Drill holes, test pits, jettings and augur holes are used to explore the sites; the first two methods are used when undisturbed samples are desired; any one, particularly drill holes with casings less than six inches, may be used to get a general idea of the material.

To obtain undisturbed drill hole samples, a 6 inch casing is generally put down. The hole is drilled by core or well drill to the level desired, the casing driven and cleaned out. Then the sampling spoon, fastened on the end of a rod, is pushed into the soil without turning; the air and water trapped by the soil entering the tube escape through the check valve. After the spoon is full, the material is sheared off at the bottom by a snare wire or by simply lifting the rod. The spoon is withdrawn, the sample removed, properly paraffined to seal all water in, and shipped to the lab.

Test pits are dug in the usual manner. Undisturbed samples are taken with a specially designed metal box, made up of metal plates and angles held together by screws, so that all sides are removable. In the field, four plates are set up to form the sides of the box; two U-shaped angles are bolted to opposite sides, with sufficient clearance between them and the bottom of the box to admit the cutting plate. The box is set on the ground and the material excavated around it so the box sinks of its own weight; when full, the top plate is screwed on, the cutting plate slipped between the lower leg of the U and the bottom of the box and the material sheared off; the box is inverted, the cutting plate and U-braces removed and the bottom fastened on.

Bag samples—about 10 lbs. of material in a can-

vas bag—are taken in sandy or gravelly material where it is impossible to obtain undisturbed samples; in this case the spoon is driven, as much material as possible recovered, and sent in as a sample.

Small mason jars are used as sample containers where it is necessary to get only a general idea of the material; attempts are made to get the sample as representative as possible; the material may be taken out with any spoon but it may be either unsuitable or unnecessary to send in as an undisturbed sample.

Laboratory Procedure—Routine Tests

The primary duty of a soils laboratory is to describe all samples so that one familiar with soils can predict their general properties and behavior. This requires classification as to main type and approximate content of other types, also a description of water content, density, size and color.

Originally, a description of the material is written after rough tests by an experienced man. After more exact tests (mentioned below), this description is checked or altered.

A value of specific gravity is originally determined for the area and then checked by occasional tests. Water content determinations are made on prospective borrow pit samples, the result being expressed as a percentage of dry weight.

When a definite change of material occurs, part of the sample goes thru a grain size analysis. Depending on the soil, this may be a sieve analysis (for sand and gravels), a hydrometer analysis (for silts and clays) or a combination of the two (when slit and/or clay run from 15% to 85% of the total.)

The sieve analysis is the same test as for concrete aggregates: a part of the dried specimen is agitated in a nest of graded sieve; the fraction retained on each sieve is weighed and computed as a percentage of the total.

For the hydrometer analysis, 50 to 75 grams of the sample are thoroughly agitated in distilled water. Hydrometer readings of the density of the solution are taken at standard time intervals; from these readings, which decrease as material settles out of suspension, and from a consideration of Stokes' Law, governing the velocity of a sphere falling through a liquid, grain size and percentages may be determined.

Samples containing both coarse and fine materials are washed through a 200-mesh seive, the part retained being subjected to a sieve analysis and the portion passing to a hydrometer test.

For all analyses, grain sizes on a log scale are plotted against total percent finer on a natural scale, to give a grain size analysis curve.

Additional Tests

The routine tests are standardized. Both procedure and theory, where theory enters, have been thoroughly worked out and there is but slight deviation in application or interpretation of results; there are a few more tests in this same category—we might mention the Atterberg limits tests, to determine liquid, plastic and shrinkage limits—but this office has not encountered many situations where they are needed. The additional tests which we now mention determine more specific properties of the soil. It may be said that the theory is fairly well developed in these cases; however, either procedure has failed to keep pace with theory or a wide range of methods are available, to be used as the judgment of the operator distates; accordingly, descriptions of these tests are general.

Permeability

Two types of permeability tests are run—on undisturbed test pit samples and on remolded bag samples. Tests are not run on undisturbed spoon samples because, as a general rule, material (silts and

Field test for compaction control. Sheepsfoot roller in background.

—COURTESY MC GRAW HILL

clays) that can be so sampled is too impervious to give definite results. On the other hand, material (sand and gravel) which is practically impossible to sample undisturbed from drill holes give definite, measurable results; bag samples of this type of material are remolded at approximately the natural void ratio. Undisturbed test pit samples are tested after the disturbed material is removed and waterproof packing placed around the sides.

Methods of testing include constant- and variable-head permeameters. For the first, a constant differential in pressure is maintained by head- and tailwater overflow weirs; a direct measurement of flow through the sample is made by diverting the tailwater overflow into a graduate. Head, time, discharge and length and area of the sample are required data to determine the coefficient of permeability.

In the second case, the differential in water pressure is applied by a standpipe of known cross section; the drop in head over a period of time in the standpipe being also a measure of discharge, the coefficient of permeability can be determined by an intergration of the formula used in the first case.

Consolidation

Consolidation of a completely saturated soil sample is based on the theory that the stress of an applied load is initially carried by the water in the voids. As the water escapes from the voids, the soil skeleton is allowed to deform and take up the stress. Hence the permeability of a soil enters into a consideration of its consolidation characteristics: a pervious sand is more rapidly consolidated than a relatively impervious clay. The theory also develops that time required for a given percentage consolidation varies as the square of the thickness of the sample.

The consolidation device consists essentially of a short heavy brass cylinder, closed at the bottom, but arranged to permit free drainage of water from the sample. The undisturbed sample, trimmed to fit the tube, is slipped into place, (a remolded sample may be molded directly in the cylinder) and cut off flush with the top; a close fitting piston is placed on the sample. The whole is then placed in an adapted commercial beam scale, through which the load is applied. Deformations are measured at standard time intervals, by means of a dial reading to thousandths. The test continues until no further deformation of the sample occurs.

From the data, a curve of square root of time against percentage consolidation may be plotted; from a series of load increments on the same sample, a pressure-void ratio, pressure-permeability and pressure-consolidation factor may be plotted; the pressure permeability curve, determined from the consolidation data, may be checked with that determined by direct permeability tests.

Shear

Two types of shear tests are in general use: direct shear and unconfined consolidation. The latter is the simplest; a cylinder of the material to be tested is placed between two bearing plates; gradual increments of pressure are applied until the cylinder fails. The major and minor principal stresses (the latter equal to zero when the sides are unconfined) being known, the shearing stress and angle of internal friction can be determined from Mohr's diagram for stress distribution in an elastic body.

In direct shear tests, the specimen is placed in a split box and held in place by plates with teeth bearing into the material; the sample is subjected to a normal force and a horizontal shearing force, which tends to pull the top of the box across the lower part, thus shearing the soil. By varying the normal loads and plotting horizontal against normal (or vertical) loads, a nearly straight line relation is obtained. The value of the horizontal force at zero normal load is the cohesion of the soil and the slope of the line is the angle of internal friction.

Compaction Tests

If soil in a fill is placed with too high a water content, it rolls out from under the compaction machinery and is not consolidated. If the soil is too dry, it may appear solid under a roller, but still may have a large volume of voids, which, when filled with water, will cause a soft mass such as first mentioned.

The desired condition is between these two extremes. It is one that will give the greatest mass density, hence the lowest voids ratio; such a mass may spring a little under a roller, but it will be almost as stable when saturated with water as when dry.

To determine the water content needed for this condition, a dry sample is tamped into a cylinder of known weight and volume under standard conditions. Weight of the soil per cubic foot, so compacted, is determined. The sample is removed, water added to a known water content and the process repeated. Several trials are made; a maximum dry weight of soil will be obtained at a water content usually near the plastic limit. A variation of one or two percent near this optimum point will not seriously affect the soil density; this is the range of water content desired during core compaction.

Solution To Problems

The method of attack on soils problems is, first, to design the structure, second, analyze the design for the various factors, third, to redesign for weaknesses and reanalyze.

After compaction tests have been made and the

Cuts Reprinted from "Engineering Properties of Soils" by Hogentogler

Failure of cohesive fill by sliding stability analysis would have shown weakness.

—COURTESY MC GRAW HILL

desired soil density determined, remolded permeability, consolidation, and shear tests are run to determine the various factors for the soil as it will exist in the core.

Using formulae developed by Dr. G. Gilboy of MIT, and the remolded coefficient of permeability, the quantity of seepage through the core can be determined, and checked if desired by drawing a flow net. If flow appears excessive, the design must then be analyzed for pressures and velocities developed by the seeping waters, to insure against "blow-outs" and piping. An adequate rock toe drain generally eliminates these problems; however, a check is advisable.

Using the theory of consolidation and the results of the remolded consolidation tests, the total amount of settlement in the core can be found, and also that part of the total settlement occurring after completion of the structure. Inasmuch as soil when fully saturated consolidates more slowly than when partly saturated, a check must be made on the rate of settlement of a saturated core, although not placed in that condition, to prevent undue allowance being made for settlement during construction.

The slope stability analysis is at present one of the most involved problems in earth design, as many factors that are difficult to evaluate completely enter a consideration of the problem. Seepage pressures, effect of sudden reservoir drawdown, cracking of soil due to drying, effect of backslope of dam on sliding surface and effect of an isotropic dam section are a few of the factors. The general method is to assume that if failure occurs the surface along which the material will slide will be an arc of a circle as proved by Fellenius and Krey; using their methods, as modified by Gilboy and Taylor, with the values of cohesion and angle of internal friction as found by tests, a stability factor of safety can be determined, taking into account the more important complicating effects mentioned above; the final design should have a factor of safety large enough to allow for those effects than cannot be completely evaluated.

Mention has already been made of the method of determining the soil density desired; field control of this factor has not yet been solved to the entire satisfaction of this office, and is at present a subject of study.

To determine the amount of settlement in the dam foundation, consolidation tests must be run on undisturbed samples. From the results and test hole data, the total consolidations and rate of settlement can be found.

Shear stresses (which cause material to squeeze out) in the underlying soil can be determined from Boussinesq's basic equation, developed by several later students, and checked against shearing strengths as determined by tests. It might be noted here again that shear strength increases as consolidation progresses; frequently, it is necessary that the structure be built up slowly to allow greater consolidation of the underground, and the consequent higher shearing strengths.

Seepage through the underground must be studied. Quantity and velocity must be considered in the design of the dam's rock toe drain. The effect of stratification must also be considered, as frequently a layer of clay or silt will act as a blanket to cut off a more pervious underlayer.

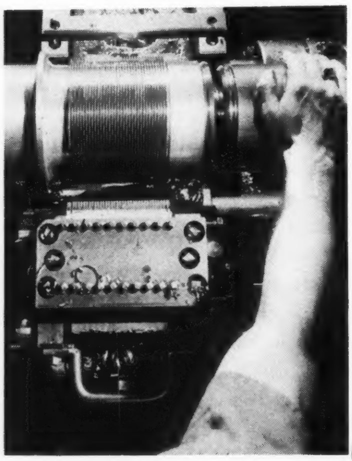
Soils mechanics, as one of the youngest fields of engineering, is helping solve this type of problem that in the past was entirely dependent upon the judgment of the engineer. Due to the heterogenity of the material with which it deals, its results must be applied thoughtfully; engineers familiar with this subject recognize its limitations and apply their results accordingly. The government should be commended for pointing the way for a more intelligent study of soil structures and foundations by its substitution of the element of investigation and study for the old one of unsupported judgment, in an attempt to prevent repetitions of past failures.

Miraculous Molybdenum

WILLIAM T. MILLS, ME '39

For the high quality steel alloys largely responsible for the development of automobiles and aviation in the last decade we look to element 42 of the periodic table. With a history of only twenty short years of commercial application, this remarkable metal, molybdenum, has risen to occupy a place of extremely high importance to the industrial world. "Moly", as it is known to its intimates, was recognized as early as the Roman period as a silver-white metallic element somewhere between chromium and tungsten, with no commercial importance, and so seldom encountered as to be classified among the rare metals. As early as the 7th century its value to steel was known to the Japanese, who used it in making their excellent swords, superior to any known at that time. What then, you may ask, accounts for its meteoric rise in the last few years of its history?

Scientific research and performance in competition are largely responsible for moly's increase in commercial importance. This rise is most clearly indicated by world consumption, which in 1916 was nearly negligible and for 1937 is expected to exceed 20,000,000 pounds. Scientific research had shown by 1900 that certain quantities of this metal would improve the qualities of steel. The fact that only small deposits of moly had been located was what held its price prohibitively high and prevented its extensive use at that time. A few years later, however, a deposit was uncovered in Colorado which later proved to contain 95% of the world's known supply. The discovery of this vast deposit and subsequent improvements in reduction methods brought the price down from the 1916 high of $5.00 a pound to a level which made quantities of it available for research and exploitation.



Machining a moly-steel engine cylinder

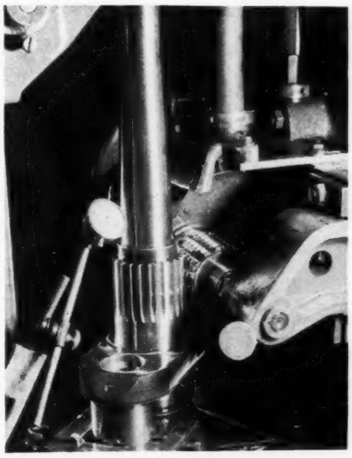
The coming of the World War with its unusual demands upon science and industry gave impetus to the development of new alloys and processes, and moly was put to work. For the duration of the war moly enjoyed a remarkable career, tentative though it later proved to be. First the manufacturers of heavy artillery found that it imparted a valuable hardness to the machine tools which were used in boring big guns. Later when British Army Officers found traces of it in captured German cannons they were puzzled until they determined that Germany, blockaded from China's supply of tungsten, must have smuggled moly in through Norway and used it in place of tungsten to toughen her special gun steels. The Allies found uses for it in making alloy steels for armor plate. It was used extensively in the crankshafts of the old Liberty aircraft engine. When the war ended, the only market which moly then knew was erased, and research engineers were forced to find new outlets for their metal.

The companies which were exploiting moly, being yet in their infancy and financially unable to undertake extensive research, decided to offer quantities of it free of charge to the major industries for development. This idea, however, was not as well received as might have been expected. When the principals of the steel industry declined to avail themselves of the large quantities of molybdenum which were offered to them for research, it was thought that the automobile industry might find applications for the metal. The automobile manufacturers were certainly alloy-minded, for they were already using chrome-nickel and chrome-vanadium in their structural parts, and moly had proven its worth in the Liberty engine. While the introduction of molybdenum to the automobile industry was slow, one step in it was striking and colorful. It concerns C. Harold Wills, Chief Metallurgist of The Ford Motor Company, one of the first men to appreciate the possibilities of adapting moly alloys to the modern motor car. Wills had been eager to adopt the

alloy long before it became commercially adaptable to the mass production methods of the industry. Wills later left the Ford organization and engineered an automobile incorporating his own ideas of design and construction and bearing his own name. Most readers will remember the old Wills St. Claire, introduced in 1921 and generally considered at that time to be one of the finest cars made in this country. Wills had fabricated his car from a combination of moly-steel alloys, and its success verified his high opinion of the value of this alloy in automobile construction. The old Wills Ste. Claire is now gone, but the developments on that fine car are what have made the automobile industry of today a prime user of moly steels.

Having made its debut in the automobile industry, moly was soon recognized by the steelmakers as a cheap and effective substitute for innumerable alloys of chromium, tungsten, vanadium, and nickel. Just what, it is natural to ask, are the qualities which moly imparts to the steel with which it is alloyed?

In the first place, through the addition of molybdenum, steels may be quenched less drastically and still be given an extraordinary hardness without the danger of hardening stresses and cracks. Molybdenum makes possible the use of the highest tempering temperatures to acquire toughness without sacrificing the hardness brought on by quenching and without the penalty of brittleness in cooling. This results in a stronger, tougher steel to withstand the wear and shock imposed by automobile drive shafts, axles, gears, and spindles. In addition, moly imparts a quality known as creep resistance, the ability to hold its strength and shape at high temperatures. When steel is subjected to a steady load at high temperature for a long time, it will tend to elongate and may eventually fail. This is particularly felt in the cracking stills of the petroleum industry where operating temperatures of 750°-1000°F. are maintained. Although several alloys are effective in resisting this creep—for a long time tungsten was thought best—moly has now replaced tungsten in the pipes, tubes, and valves of the oil-refining industry. A fourth quality which molybdenum imparts is depth-hardness, that is, a uniform hardness throughout, at the core and on the surface. No other alloying metal imparts the same uniformity of hardness; hence moly finds uses in heavy machinery, forging dies, and heavily loaded shafting. Another favorable characteristic is that molybdenum steels can be welded and machined much more easily than any other steels of the same hardness. One notable feature of molybdenum is that all these qualities may be imparted to steel by the addition of only five pounds of moly to the ton. By raising the content to 150 pounds to the ton a new property known as red-hardness emerges. This characteristic



Finishing an airplane crankshaft of moly-steel.

means that the steel will hold its hardness even up to red heat and makes moly especially valuable to steels used for high speed cutting tools. It was formerly thought that only tungsten steels could cut at temperatures which were required of high speed cutting tools, but moly was soon found to be quite as effective; and the present trend is to reduce the tungsten content to little more than a trace and make up the difference with molybdenum.

It would be incorrect, however, to regard moly as a complete substitute for other alloying metals, for it cannot replace the stainlessness of chromium, the ductility of nickel, or the fine grain imparted by vanadium. In fact, it is seldom used alone and does its best work in combination with one or more other alloying metals. The four standard steels in which moly plays a part are carbon-molybdenum, chrome-molybdenum, nickel-molybdenum, and chrome-nickel-molybdenum. An investigation of the properties of any one of these alloys would require far more space than is available for this brief outline, and would result in a highly technical discussion which we shall avoid.

Steel so largely dominates our picture of molybdenum that we may tend to overlook the other important uses to which it is put. Today cast iron gears, valves, brake drums, cylinder blocks, and mill rolls are being produced which contain a certain amount of moly to impart greater tensile strength, and impact and wear resistance. Moly seems to be the one alloy which is best able to do this because it interferes least with the machining qualities of the finished metal. Chemistry has found attributes of molybdenum which give it an extensive and varied application in that field.

(*Continued on page forty-two*)

IT REQUIRES no long acquaintances with Cornell to bring a realization that Cornell engineers are a tower of strength not only in the engineering profession of the country but also in the affairs of the University. I welcome this opportunity to add my voice to the wide acclaim of the splendid record of the Cornell Engineering Schools. The many distinguished careers of the graduates of these Schools attest the excellence of the work that has been done.

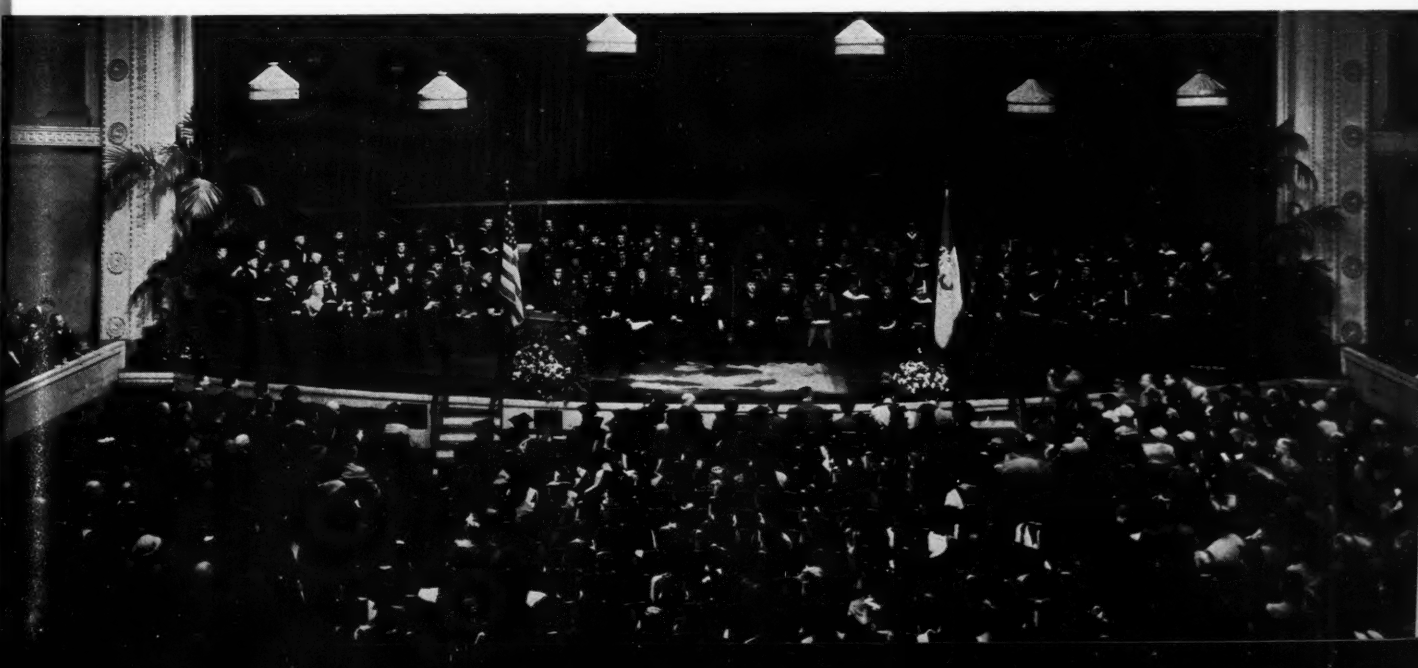
It happens that circumstances of my own earlier years give me a special interest in engineering and hence in the Cornell Engineering College. I view with much satisfaction the opportunity I have as president of the University to endeavor with others to raise the Engineering College to even higher levels of achievement. No part of the responsibilities of my office will interest me more. I extend to the great company of Cornellians who share this interest with me—graduates, students and members of the faculties—my personal and official greetings as well as assurances of my earnest desire to serve the Engineering College with all the resources at my command.

Edmund E. Day

Marching, as tradition prescribes, at the very end of a brilliant academic procession, Dr. Edmund Ezra Day entered Bailey Hall on October 8 to be inaugurated as Cornell's fifth President. A graduate of Dartmouth, former professor at Harvard, and onetime dean of Michigan's School of Business, Dr. Day was formally greeted by the presidents of these three institutions before his induction into office by Judge Frank H. Hiscock '75, chairman of the Board of Trustees.

The picture below shows the scene in Bailey Hall just before President Day arose to deliver his inaugural address. Beside him are two former presidents of Cornell, the three other speakers, and Governor Lehman. Behind him are some of the 300 official delegates, representing other colleges and universities, learned societies, education foundations, and the Trustees, Faculty, alumni, and students of Cornell.

It was an impressive occasion, as the new President pledged his devotion to Cornell's traditional policies and ideals—equality of all studies, freedom of inquiry, the unhampered search for and dissemination of truth. Those who heard his address came away with the firm conviction that the University's future is in capable hands, and that Cornell will go on to finer and greater achievements.



Cuts by courtesy of the Climax Molybdenum Company and "Scientific American" magazine.

Flotation cells in a modern molybdenum ore reduction plant.

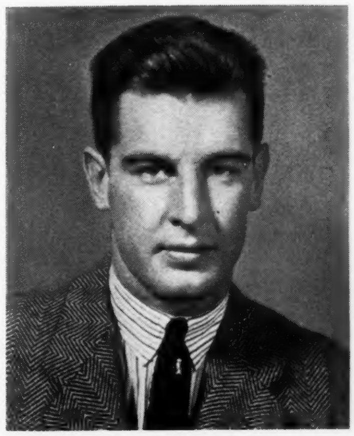
In the manufacture of color lakes, insoluble colors made from organic dyes, moly has been used principally to replace costlier tungsten without sacrifice in quality. It is also being used in pigments, the inorganic compounds, the best example of which is molybdenum orange, which gives twice the covering power of its predecessor, chrome orange, at a lower cost. The addition of molybdenum compounds lends opacity to enamels and glass; for this purpose it is now coming into wide use. At the present time it is just making its debut as a catalyst, and while little has been said about this phase of its importance, moly is known to have uses in destructive hydrogenation and acid contact processes. Its action as a catalyst is known to be extremely violent; in fact, so much so that the addition of pacifiers is in most cases necessary. The knowledge of this force has stimulated research to determine whether or not it might be used to accelerate combustion of fuels and increase their efficiency. A few other uses which bear mentioning are: molybdenum stainless steel tips for pens, filaments for electronic tubes, contacts for communication systems, and bases for brilliant inks and dyes.

Having seen a few of the many uses to which the metal molybdenum is put, let us now consider the stages through which it must pass before it becomes ready for commercial application. It is found in the ore as molybdenite (molybdenum sulfide), but cannot be refined from this ore by the ordinary smelting process because of its high melting point (more than 2600°C.). The ore is blasted from the earth and removed in large blocks to a crusher, where it is broken down. The next stage is a grinding operation to reduce the ore to a pulp, which is placed in boxlike flotation cells. These cells contain a mixture of pine oil and water, which is agitated while compressed air is being blown up from the bottom forming a froth of oily bubbles. To the surface of these bubbles the sulfide particles cling, and when they have reached the top of the cell they are scraped off with rakers, the gangue, or waste, sinking to the bottom. Lime is now added and the concentrate, hot from its own sulphur content, is raked over a series of hearths in a large multiple-hearth roasting furnace, ending up as calcium molybdate, a cream-yellow chalky powder which needs no crushing and enters readily into combination with steel. In this form it is placed in bags, generally twelve pounds of the molybdate, which equal five pounds of pure molybdenum. It is now tossed, bag and all, into the open hearth furnace, either with the cold charge or on top of the fuming slag, the calcium remaining with the slag and the pure moly entering into combination with the steel to perform its molecular wonders.

Perhaps more than any other metal, molybdenum may be considered a research product. Known to the Romans and early Japanese, moly remained in obscurity until research gave it commercial reality and an ever widening field of application. Beginning with Scheele's discovery of the element in 1778, and Hjelm's subsequent isolation of the pure metal four years later, research has transformed molybdenum from a graphite-like substance of no particular value to an element of great commercial significance. What new uses the research workers of the future will find for this versatile metal is hard to say, but if moly continues to show the same meteoric development which has characterized the last ten years of its use we may expect to see some amazing advances through its use even in fields hitherto considered independent of metallurgical development.

GRAHAM EVANS MARX

Do You Know These Men?



ELLIOT HOLDEN HOOPER

Managing the affairs of Cornell's varsity oarsmen through what promises to be a very successful season this year, is Graham Evans Marx '38 AEME of Cincinnati, Ohio. Before entering Cornell, Marx attended Walnut Hills High School, where his numerous activities included President of the Student Council and member of the football squad.

His freshman year Graham received his numerals in Crew, and the following year decided to compete for managership of that sport. Having been successful in his competition, Graham is now Manager of Varsity Crew and a member of the Crew Club. His other activities include the Sophomore Smoker Committee, Freshman Advisory Committee, and Navy Day Ball Committee. A member of Tau Beta Pi, Marx is also associated with Kappa Tau Chi, Aleph Semach, Sphinx Head and President of his fraternity, Chi Psi.

Interest in crew came rather naturally, for Graham has always been interested in competitive boating. His particular hobby is outboard motorboat racing at which he has had more than average success. Using a hull which he designed and built himself and a standard outboard motor, Graham has acquired a sizeable collection of racing awards and trophies during the summers which he spends at his family home in Canada. His record stands at only six miles an hour less than the professional record for his class—pity the other amateurs who have to face this high-speed combination.

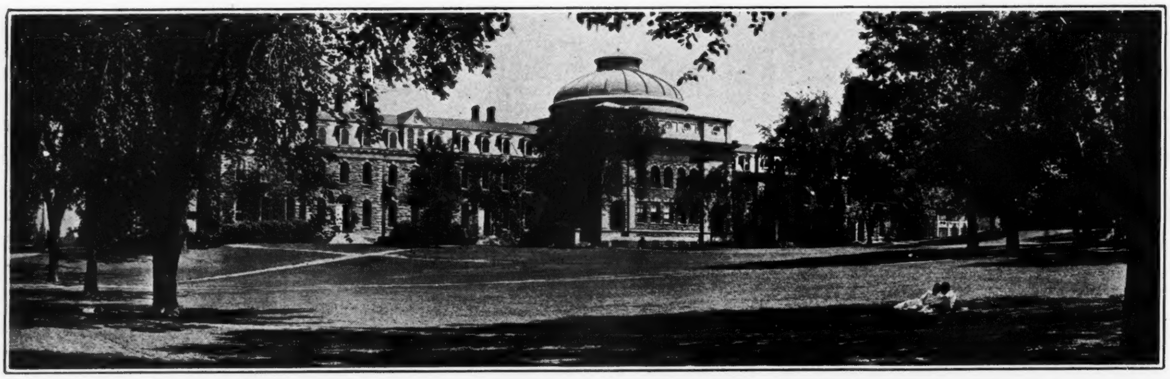
In his undergraduate life, Marx has tried to balance scholastic work with social activities and committee work to complete a well-rounded education. After college he plans to enter the machine tool industry, eventually assuming a place in his father'sorganization, which is in this field.

As you have watched the Big Red football team in its scoring rampage this year you have probably been struck with the accuracy and distance of the brilliant punting which has characterized the team this year. Responsibility for this remarkable kicking goes to Elliot Holden Hooper, '38 AEME of Mount Vernon, New York.

Hoop, as he is known to his friends, got off to a flying start his freshman year by winning his numerals in both football and track. He has continued his atheltic efforts, having won his varsity letter in both of these sports, and done much in the other fields of extra-curricular activity. A member of the Student Council, Hooper is also a member of Spiked Shoe, Aleph Semach, Sphinx Head, Mummy, and has served on the Freshman Advisory, Freshman Banquet, and Junior Prom Committees.

Following his freshman year Hooper spent a summer working in a diesel testing laboratory on small commercial engines. Last summer he occupied himself with the task of underpinning buildings. The climax of this experience was the total and complete destruction of a barn following which he and some friends hastily took to the road for a short trip before the beginning of football practice this fall.

Elliot has not as yet decided just what line of work he will enter after graduation. He feels that the first job should serve only as a groundwork for future endeavor and it is from this that he hopes to decide just what his life work will be. Whatever his final decision is we hope that the success which Hooper has enjoyed in college will continue to be his in the business world.



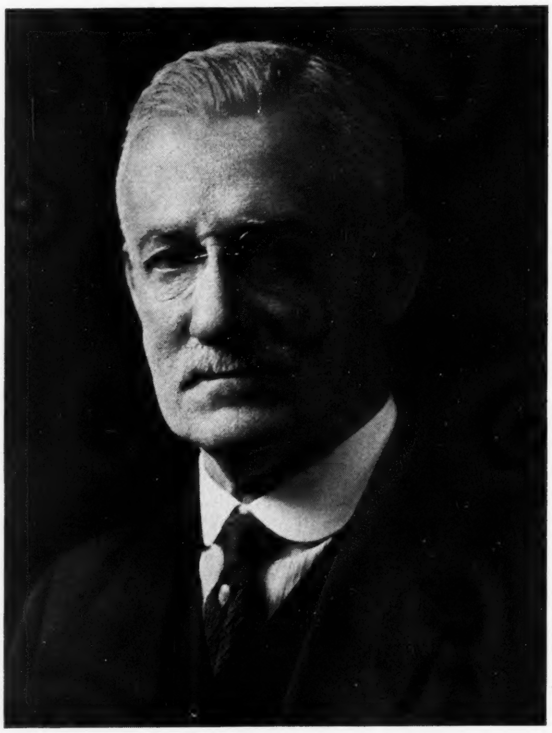
COLLEGE NOTES

IN MEMORIAM

Professor Emeritus George Robert McDermott, who for many years taught Naval Architecture in the College of Engineering, Cornell University, passed away at his residence, 205 Willard Way, Ithaca, on May 26, 1937, thus further reducing the group of Professors who made the regime of the late Doctor Robert Thurston famous.

Professor McDermott, or "Mac" as he was affectionately known to his colleagues and to generations of students, was born in Glasglow, Scotland, in 1860. He received his technical education in the Technical Institute of Glasglow. After graduation he entered the employ of the famous Clydebank Shipbuilding and Engineering Company, where the Queen Mary and many other famous ships have been constructed, rising to the position of Naval Architect and Assistant to the Shipyard Manager. In 1890 he joined the Southhampton Naval Works as Naval Architect and Assistant to the General Manager. He came to Cornell in 1892 as Assistant Professor of Naval Architecture and was promoted to full professorship in 1904. From that date until his retirement in 1929 he was in charge of the work in Naval Architecture in the College of Engineering at Cornell.

Professor McDermott was much in demand as a Consulting Engineer, the Cunard and other steamship lines calling upon him frequently for advice. During the years 1910-12, while on leave of absence from the University, he was appointed by the Brazilian Government as Engineer-in-chief in the organization and construction of the Naval Repair Station of Lloyd Brazileiro at Ilka de Mucangue, Rio de Janeiro. Again on leave from the University in 1917, he was appointed by General George W. Goethals as District Officer of U. S. Shipping Board Emergency Fleet Corporation, and afterwards was appointed by Chairman E. N.



Professor Emeritus George Robert McDermott
1860-1937

Hurley as District Officer of the Corp. which position he filled until the end of the World War.

He was always very active in the broader aspects of naval work and was recognized as an authority in such matters. In 1921 he was appointed by the U. S. Government as Chairman of the Government Commission on Loadlines of Mercantile Vessels for the At-

lantic and Gulf Division, and he was a member of many committees interested in Marine problems. He was a member of the Society of Naval Architects and Marine Engineers, of Sigma Xi, Tau Beta Pi, and was the author of many papers and several books in his field, notably, the "Screw Propeller Computer" and "Textbook on Screw Propellers."

Professor McDermott was a most excellent teacher. His own scientific background was thorough and he had no patience with weak or slipshod methods of instruction. He was a thorough believer in instilling what he always described as the "fundamentals" into the minds of his students. Yet his vigorous lectures and his rigid classroom instruction were tempered with rare humor and a winning smile. Those who elected his work were always enthusiastic over it and the success of his students bears witness to the soundness of his methods. "Mac" was a sociable man, widely informed, often a little vociferous in expressing his opinions, honest, upright, and loveable. He will be missed by a host of friends.

He is survived by one son, George Rolland, Cornell 1905, and a daughter Jean of Ithaca.

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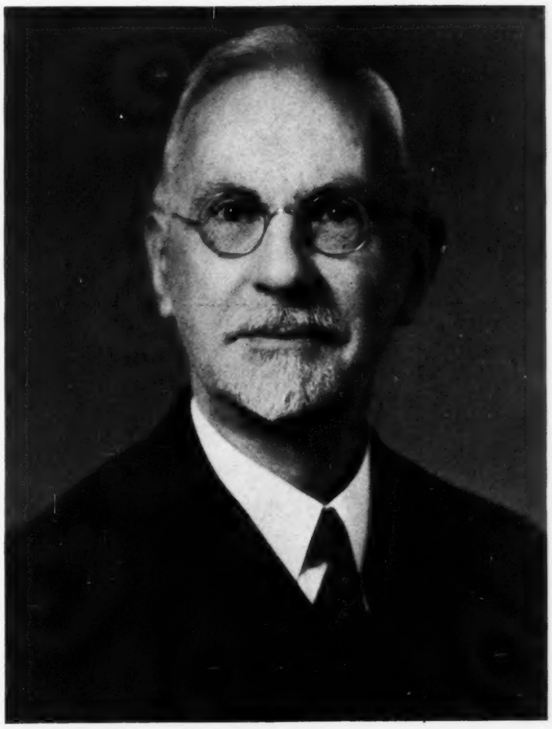
PROFESSOR E. H. WOOD RETIRES



PROFESSOR EMERITUS EDGAR HARPER WOOD

A host of former students and other friends will regret exceedingly to learn of the retirement from active duty of that kindly and respected teacher, Professor Edgar Harper Wood, who for many years has served so acceptably as head of the Department of Mechanics in the Sibley School. Having continued in recent years under the handicap of poor health he has now found it advisable to seek relief from teaching and administrative duties. His retirement became effective on August 13, 1937, and is with the rank of Professor Emeritus.

Born on August 15, 1862, near Topeka, Kansas, Professor Wood came to Ithaca as a boy when his father, William H. Wood, became foreman of the wood shop in Sibley, in which capacity he gave instruction in wood working to successive classes until 1904. Professor Wood was brought up in the college environment and entered Sibley as a student in 1888. In 1892 he received the degree of M.E., and the next year was a graduate student, receiving the M.M.E. degree in 1893. He served as the principal of the Manual Training High School in Dayton, Ohio, for several years, and returned to Cornell University in 1899 as instructor in Drawing. In 1907, he was promoted to an assistant professorship in Machine Design. When the present Department of Mechanics in the then Sibley College was formed in 1910, he was appointed professor and head of the department, which position he held until his retirement. Professor Wood is the author of an extensively used "Textbook of Mechanics", and coauthor of "Kinematics of Machinery", and "Strength of Materials". He is a member of Sigma Xi, and of The Society for the Promotion of Engineering Education. An inspiring teacher, a trusted adviser, and a sound thinker, Professor Wood has endeared himself to his students and his associates. He has encouraged those with whom he has worked by his thoughtful assistance. A hard worker, he undermined his health in the interests of the University. His mental vigor has always been prodigious. Never a self seeker, he has given credit to others which rightly belonged to himself. No statement of Professor Wood's accomplishments should omit mention of the help and stimulation given him by his wife.

It is indeed fortunate that Professor Wood will retain his residence in Ithaca so that his kindly advice and willing assistance will be available to his associates and to the students, but Sibley School will not be quite the same without his active presence. May he long enjoy the leisure he has richly earned.

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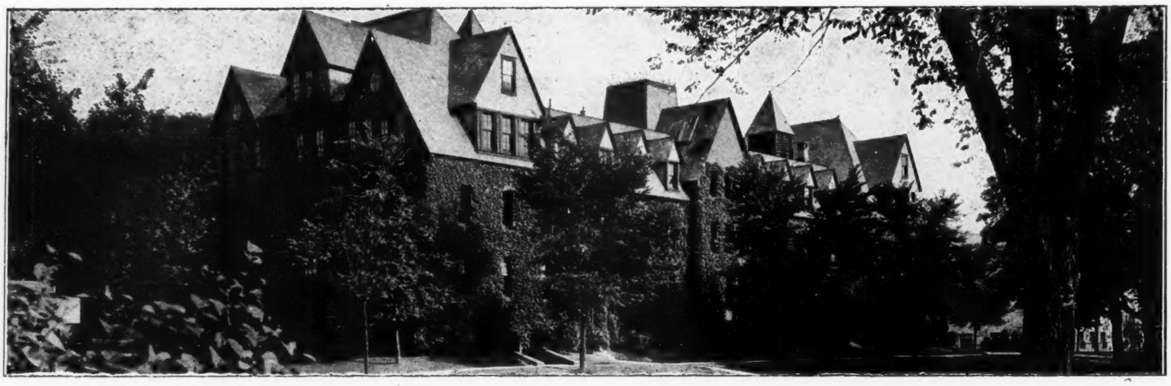
ANNUAL ENGINEER'S BALL

The first week-end in December is the time reserved this year for the annual Engineer's ball to be held in the Drill Hall under the auspices of the engineering



honor societies. Characterized by the swing music of one of the more prominent nationally known dance bands, coupled with a new and unusual scheme of decoration, the dance promises to be one of the outstanding social events of the season. Designed primarily to provide a good time for everybody, the affair has as a more serious purpose—the object of gaining funds to defray the expense of the Engineering Show which is held annually in connection with Cornell Day. This is our dance, fellow engineers, so let's give it our wholehearted support and prove to the rest of Cornell that we are still able to put on the smartest dance of the year.

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FACULTY CHANGES IN M.E.

In the Department of Administrative Engineering Mr. A. S. Schultz, Jr., has been appointed instructor to take the place of Mr. Millard, who has been transferred to another Department. Mr. Schultz graduated from Sibley with the Degree of B.S. in Administrative Engineering in 1936. During his student days he was Secretary of Tau Beta Pi, Treasurer of Scabbard and Blade, member of Kappa Tau Chi, and President of Phi Gamma Delta. After graduation, he entered the training course of the New Jersey Bell Telephone Company which he gave up to accept the present appointment.

In the Department of Industrial Engineering, Clyde I. Millard has been appointed to an Assistant Professorship to assume the duties performed last year by Mr. W. D. Vanderbilt, who resigned in June. Professor Millard graduated from Cornell with the Degree of Electrical Engineering in 1927 and served several years as instructor in the Department of Machine Design. Since 1933 he has held an instructorship in the Department of Administrative Engineering. In addition to his teaching experience, he has had wide experience in the industrial field.

In the M.E. Department of Mechanics, Professor F. G. Switzer has been appointed Head of the Department, succeeding Professor E. H. Wood, retired; and Mr. George H. Lee has been appointed to an instructorship. Mr. Lee is a graduate of the University of Pittsburgh, from which he received the degree of Bachelor of Science in 1936. During the last academic year, he held a McMullen Research Scholarship in our College of Engineering, and in June 1937 was granted the Degree of Master of Science in Engineering, his thesis being entitled, "The Theory of the Photoelastic Effect." For five years he was research assistant in in the Aluminum Research Laboratories. He is an associate member of Sigma Xi.

In the Department of Heat Power Engineering, Professor Warren H. Hook is on Sabbatic Leave during the first term. He spent the summer at the General Electric Company and will be with the Detroit Edison Company until he returns. Mr. H. N. Fairchild is taking charge of Professor Hook's work during the latter's absence. Professor C. O. Mackey will be on Sabbatic Leave during the second term of this year.

The Department of Machine Design has two new members on its staff. Paul Howard Black has been appointed Assistant Professor to succeed Professor Colin Carmichael, who resigned in June. Professor Black has been teaching Machine Design in the University of Illinois during the last nine years and also has had valuable training elsewhere for his work with us. He received the M.E. Degree from Rensselaer Polytechnic Institute in 1925 and the M.S. Degree from the University of Pittsburgh in 1931. From 1925-1926, he was an instructor at Rensselaer, and from 1926 to 1928 was with the Westinghouse Manufacturing Company and took, in conjunction with the University of Pittsburgh, many advanced courses in mathematics, physics, and mechanics. Also he took a special course in Photoelasticity at Carnegie Institute of Technology and last summer attended the advanced course in Strength of Materials given at M.I.T. He is author of the University of Illinois Bulletin (1937) entitled "An Investigation of the Relative

(Continued on page fifty-four)

ALUMNI NOTES

'00ME—Wilfred W. Wright is president of Savage Arms Corporation. He is living at 60 East 42nd Street, New York City.

'03 MCE.—Francis M. Dawson, formerly a member of the department of hydraulic and sanitary engineering at the University of Wisconsin, is now Dean of the College of Engineering at the University of Iowa, Iowa City.

'11 ME; '12 AB—Munroe F. Warner is a metallurgical engineer, with offices at 50 West Broad Street, Columbus, Ohio. He writes, "I left Newark, N. J., the first of the year, and have since been engaged in metallurgical work in Tennessee, Arkansas, Oklahoma, Missouri, Illinois, and Ohio." Mrs. Warner is the former Margaret Mandeville '12.

'13 ME—Benjamin F. Bardo was transferred June 15, from assistant superintendent of the Boston division to assistant superintendent of the Hartford, Conn., division of the New York, New Haven, and Hartford Railroad. His address is 818 Summer Avenue, Springfield, Mass.

'14 ME.—Alexander Davis is chief engineer of the Maine Seaboard Paper Company, Bucksport, Me.

'17 ME—William C. Kammer and Associates, consulting engineers, have moved their offices from Smythe Building to 1900 Euclid Avenue, Cleveland, Ohio.

'18 ME—Everette J. Rutan was appointed Superintendent of the Test Bureau of the Consolidated Edison Company in January. He is in charge of work in Manhattan, Brooklyn, and Queens, with offices at 55 Johnson Street, Brooklyn.

'21, '24 ME—Mr. and Mrs. Carlyle M. Ashley now live in Syracuse, at 207 Brattle Road. Mr. Ashley is with the Carrier Engineering Corporation.

'23 ME—Beauchamp E. Smith, R. D. 6, York, Pa., has been elected general Manager of S. Morgan Smith Company, manufacturers of hydraulic turbines. He was formerly secretary of the company.

'24, '25 ME—Vincent L. Kohl is plant accountant with the Commonwealth Edison Company, Room 900, 72 West Adams Street, Chicago, Ill.

'25 EE—D. Gordon Angus, 60 Roxon Road, Rockville Center, is employed as patent lawyer by Edwards, Bower and Pool, 63 Wall Street, New York City.

'26 CE—John R. Zehner is construction engineer with Montgomery-Ward and Company. He was married to Margaret Bolles of Bellows Falls, Vt. He and Mrs. Zehner are now at Mansfield Falls, Ohio, where he is superintendent. His permanent address is 35 Herkimer Street, Brooklyn, N. Y.

'26 ME—Leonard B. Richards, 15 Bradley Street, Butnam, Conn., is gas engineer with the Connecticut Light and Power Company.

'29, '30 EE—John D. Russell, Franklin, Pa., after seven years in the engineering department of the Joy Manufacturing Company, the last three as an electrical engineer, has been transferred to the sales department as sales engineer.

'32 CE—Frederick B. Ferris, 500 Cheltenna Avenue, Jenkintown, Pa., is an operating engineer with the Atlantic Refining Company, Philadelphia, Pa.

'32 ME—Allen R. Green is a test Engineer with the Atlantic Refining Company, Philadelphia, Pa. His home is at 83 South Lansdowne Ave., Lansdowne, Pa.

'34 ME—Robert R. Thompson is process supervisor at the Kansas City, Kan., plant of the Procter and Gamble Manufacturing Company.

'36 EE—From Charles H. Leet, comes news of three of the many Cornellians employed by General Electric. Mr. Leet has been working, for the past year or so, with Llewellyn Collings and Alexander Wall, also of the class of '36, in the parent plant at Schenectady; however, he has recently been transferred to the Bloomfield, N. J., plant, and is now living at 40 East Park St., East Orange. Alex Wall is remaining in the Schenectady plant, where he has been selected from a rather large number of applicants to take the advanced engineering course offered by the company. Collings, also in the parent plant, took the course last year. Cornell is one of the few colleges having more than a hundred graduates employed by General Electric.

'36 ME—Leonard C. Marsic is engineer in charge of gear production and machinery with the Singer Mfg. Company, Elizabeth, N. J. He lives at 109 Crabford Ave., Cranford, N. J.

'37 CE—Carl Scheman is working in the Irvin Works of the Carnegie Illinois Steel Corporation in Pittsburgh, Pa.

(Continued on page fifty-five)

President's Column

October 15, 1937

Fellow Engineers:

Dr. Day, at the meeting given last spring in his honor by the Cornell Society of Engineers, told us of his personal interest in engineering and his hope and intention, when he became President of the University, to familiarize himself quickly with the pressing problems facing the Engineering Colleges. How encouraging were his words!

To enumerate even a few of these problems and responsibilities confronting the new President, the Trustees and the faculty, is sufficient to show the importance of careful and clear thinking necessary for the welfare of Cornell's engineering schools.

In the appointment of Professor S. C. Hollister as Dean, the places of not less than three new directors of the Colleges must be filled. The finding of proper men for these directorships is of grave importance and upon proper selection depends the advancement of Cornell's prestige and reputation.

Take the matter of new buildings and new equipment for the colleges. Location, size, planning of class rooms, laboratories, the type and amount of new equipment, priorities in construction, unit costs, etc., are questions requiring deep study. How much money will be needed and how will it be raised?

How soon can the engineering colleges develop a program whereby faculty members, relieved of part of their teaching routine, may devote time to research and to inspire the desire for research in the hearts of the students? Clarence Hirshfeld, M.M.E., '05, in a recent article in this magazine, said that it is becoming more and more evident that research is the life blood of institutions such as is Cornell.

You have seen the engineering bulletins issued periodically by other engineering schools; for example, the bulletins of the University of Illinois and Iowa State College. These contain original articles and results of research and tests of engineering materials, new products, etc. In many cases these articles contain data on subjects available nowhere else and are, therefore, extremely valuable. How wonderful to have such analytical work and such important bulletins produced at Cornell! A start on it has been made. Shall such a project be further developed?

These and many other problems face our new President, his officers and advisors. The engineering alumni, as represented by the Cornell Society of Engineers, naturally take a deep interest in them and will cooperate and assist the University to the full extent of their ability and opportunity.

The importance of our participation in the solution of engineering problems faced by the University officers is somewhat in proportion to the ability of the Society to say it truly represents the Alumni. Of course, this ability increases with our membership. We would, therefore, welcome membership applications from all engineer alumni who read these words.

Very truly yours,

CORNELL SOCIETY OF ENGINEERS,

By GUSTAV J. REQUARDT
President

Cornell Society of Engineers

CONSTITUTION

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Article I—Name and Object

Section 1—The name of this Society shall be the Cornell Society of Engineers.

Section 2—The objects of this Society shall be to promote the welfare of the College of Engineering of Cornell University, its graduates and former students and to foster a closer relationship between the college and its alumni.

Article II—Membership and Dues

Section 1—Regular membership in this Society shall be open to those persons who were, for one year or longer, students at, or members of the faculty of the College of Engineering of Cornell University.

Section 2—Honorary membership shall be limited to a total of twelve members and not more than three new honorary members shall be elected during any one year. Proposals for honorary membership shall be made by petition of at least fifty regular members and the proposal published in official organ. Not sooner than two months after such publication, the executive committee shall vote upon the proposal and election shall require affirmation by four-fifths of the entire committee membership. Vote shall be by letter ballot.

Section 3—Dues shall be as set forth in the By-Laws. Honorary members shall be exempt from the payment of all dues.

Article III—Officers

Section 1—The officers of this Society shall be a President, Executive Vice President and such Regional Vice Presidents as determined by the Executive Committee in accordance with the By-Laws, a Corresponding Secretary, a Treasurer and a Recording Secretary.

Section 2—Officers shall be elected and installed at the Annual Meeting, to hold office for one year or until their successors are duly elected in a manner provided for in the By-Laws.

Section 3—Duties of Officers

(a) The President shall preside at all meetings of the Society and shall be Chairman of the Executive Committee, and be Ex Officio member of all committees, except the Nominating Committee. He shall see that the Constitution and and By-Laws are observed.

(b) Executive Vice President

The New York Regional Vice President shall be the Executive Vice President and in the absence of the President, the Executive Vice President shall assume those duties given to the President by this Constitution.

(c) Corresponding Secretary-Treasurer

The offices of Corresponding Secretary and Treasurer shall be combined in one, it being the duty of this officer as Corresponding Secretary to notify all members of regular and special meetings of the Society at least one week in advance of such meetings. In case of a special meeting he shall state the object for which the meeting is called. Upon request of the President he shall give notice of meetings of the Executive Committee to the members of that Committee. He shall conduct the correspondence and keep the records of the Society except as otherwise provided. He shall keep a careful record of the names and addresses of all members of the Society and shall perform such other duties as the Executive Committee may assign to him. As Treasurer it shall be his duty to collect the dues and to keep full and accurate accounts of the financial transactions of the Society. He shall deposit all moneys in such depository as may be designated by the Executive Committee. He shall pay out money by check signed by him as Treasurer whenever authorized by the Executive Committee. He shall render an account of all his transactions as Treasurer at the annual meeting, or whenever required by the Executive Committee, and shall perform such other duties as may be prescribed by it.

(d) Recording Secretary

It shall be the duty of the Recording Secretary to record minutes of all meetings of the Society and of the Executive Committee, and to perform such other duties as the Executive Committee may assign him or as provided for in the By-Laws.

Section 4—Vacancies

When an office shall become vacant it shall be filled by the Executive Committee.

Article IV—Meetings

Section 1—The Executive Committee shall call two regular meetings of the Society each year, one of which shall be held during the first week of May and shall be known as the Annual Meeting. The other meetings shall be held preferably during the week of the annual convention of one of the national engineering societies.

Section 2—Special meetings shall be held as provided for in the By-Laws.

Article V—Committees

Section 1—(a) The Executive Committee shall be the governing body of the Society and it shall be the Executive Committee's duty to carry out the objects and purposes of the Society, for which they are hereby vested with power to take action on any subject within the Constitution and By-Laws.

(b) The membership of the Executive Committee shall be composed as set forth in the By-Laws.

Section 2—The following shall constitute the standing committees of the Society and their membership shall be composed as set forth in the By-Laws.

(1) Committee on Regional Sections
(2) Committee on Publications
(3) Committee on Meetings
(4) Committee on Alumni Representation

Section 3—Special Committees

(a) Nominating Committee

Each year, at least two months prior to the annual meeting, a Nominating Committee shall be selected by a two-thirds majority vote of the Executive Committee to nominate one candidate for each of the offices, except the Regional Vice

Presidents, to be filled at the forthcoming annual election. Each candidate must consent to his nomination before it is valid. The report of the nominating committee shall be submitted to the Executive Committee and published in the official organ at least two weeks prior to the election.

(b) Other special committees may be appointed by the Executive Committee as they consider necessary and these committees shall serve until they render a final report.

Article VI—Amendments

Section 1—This Constitution may be amended at any annual meeting by a two-thirds vote of the members attending the meeting. Amendments shall be drawn up by the Executive Committee and submitted to the membership by publication in the official organ at least one month prior to the annual meeting at which the amendment is to be voted upon.

BY-LAWS

Article I—Headquarters

Section 1—The headquarters of the Society shall be at some convenient place in New York City, designated by the Executive Vice President.

Article II—Meetings

Section 1—The Executive Committee may call special meetings in addition to regular meetings. No business may be transacted at any meeting unless at least a quorum is present and a quorum shall consist of at least 25 regular members.

Article III—Dues

Section 1—The fiscal year shall run from June 1 to May 31. Dues shall be $2.00 per year and be payable June 1. There shall be no assessments for any purpose.

Section 2—Annual dues for members shall be $1.00 for the first year after graduation from the College.

Article IV—Committees

Section 1—(a) The Executive Committee shall be composed of the elected officers, 3 past living presidents, chairman of the standing committees and 6 members at large elected by the officers, 2 from each school of the College of Engineering. Members at large shall serve a term of 2 years and only 3 members shall be elected each year, except when a vacancy occurs. Vacancies shall be filled by a majority vote of the Executive Committee.

(b) Meetings of the Executive Committee shall be held at the headquarters of the Society and shall be called by the Executive Vice President. Members shall be notified of all meetings, except in an emergency, at least one week in advance of meeting and a quorum shall consist of 5 members.

Section 2—All committees, except where otherwise provided for elsewhere in the Constitution or By-Laws, shall be appointed by the Executive Vice President with the approval of the Executive Committee.

Section 3—The Chairman of the Committee on Alumni Representation shall act as the Society's representative on the Engineering College Council. All dealings with the Council, the Faculty and the Officers of the University shall be transacted through the Chairman of the Committee on Alumni Representation, and the Chairman of this Committee shall keep the Executive Committee informed of any such transactions by reporting to it at its meeting.

Section 4—Publications

The CORNELL ENGINEER published by the student body of the College of Engineering shall be the official organ of the Society. Copies of each issue of the CORNELL ENGINEER shall be sent to every member of the Society for that year in which he has paid his dues. A complete list of dues paid members shall be furnished to the Treasurer of the CORNELL ENGINEER before September 10 of each year, which list shall be supplied to the Chairman on Publications by the Treasurer of the Society. Payment shall be made to the Treasurer of the CORNELL ENGINEER for the annual subscription of members on this list in accordance with the agreement between the Executive Committee and the management of the CORNELL ENGINEER. All agreements made with the CORNELL ENGINEER must have the approval of the Executive Committee.

Section 5—Regional Sections

The Committee on Regional Sections shall encourage and help promote formation of and activities of regional sections. When in the opinion of the Executive Committee such a group has reached the size to warrant, a Society Vice President may be created for that region and the members of that section each year shall elect one of its members to that post.

Article V—Amendment to By-Laws

Section 1—These By-Laws may be amended by a two-thirds vote of the entire Executive Committee. Voting shall be by letter ballot.

Article VI—Officers

Section 1—Election

Unless, as provided herein, there are other nominations presented than those of the Nominating Committee, the voting shall be viva voce, the Secretary to report on the number of letter ballots received.

Should any candidate as published not be satisfactory to the membership at large, additional nominations may be presented to the annual meeting. Such nominations must have at least 50 signatures, and shall contain at least 10 from each constituted regional group. In such event the election shall be by ballot at the annual meeting.

Any member may vote by letter ballot for officers of the Society who have been duly nominated in accordance with the Constitution or By-Laws.

To be valid such letter ballots must reach the Headquarters of the Society 24 hours before the scheduled opening of the annual meeting.

STRESS and STRAIN

To take up some of the large open spaces occurring in this column every month at this time, we have purloined the following from the California Engineer which has in turn lifted it from the Penn State Froth, whatever that is. Evidently the boys at Penn State get around, apparently enjoying their games as they go. Anyway, here they are:

Throw the Anvil: One of the party is blindfolded and made to balance an anvil in one hand and a co-ed in the other. At the count of three he tosses them both in the air. If the girl falls on the anvil, he gets ten points. If the anvil falls on the girl, he gets a rousing cheer from the brothers.

Marching to Jerusalem: In this game, all of the girls sit on chairs in a circle. At a given signal the boys dash madly around the circle and pull the chairs from under the girls. The blindfolded person feels silly as hell.

Blind Man's Buff: The lights are turned off and everyone throws his bottle into the center of the room. At a given signal there is a rush for the pile, and the one who comes out without any bruises is lucky.

Who Killed Cock-Robin? Someone is blindfolded and asked to put his hands behind his back. A pail of water is then thrown in his face and when the lights are turned on everyone laughingly cries, "Old Maid!"

Just the same we think it sounds strangely like the bachannal revelry of the board members of our little known contemporary, the Cornell Daily Sun.

* * *

We are sometimes fascinated by the quaint humor of Carl, our linotyper. His latest attempt has us rolling on the mill floor (you've certainly heard of rolling mills). Anyway, galley proof of Stress and Strain came back with a cute little heading which for sheer accuracy takes the proverbial cake.

Engineer leftover—Stress and Strain—I guess—*Oy*.

* * *

A Definition: Research—A blind man in a dark room looking for a black cat that isn't there.

—*Montana Engineer*

* * *

One of the hardest problems in engineering efficiency is that of deciding whether to stay in bed all morning when we have no classes or getting up early so we'll have a longer time to loaf.

Prof: (taking breath at end of hour)—"ah just what time is it?"

Usual Voice from Rear: "There's a calendar right behind you, sir."

* * *

And from the University of Wisconsin, via the Sun, comes another of the Sun scoops on factual knowledge:

Students dancing to swing music—1200 of them—generate enough heat to warm a two story house for two days in ordinary winter weather. Enough energy is realeased to raise a five ton elephant 32 miles in the air. Silly, isn't it? What about respiration for the poor elephant—also air pressure, riveted strength of elephant hide, means of getting down again without serious injury, factor of safety, etc. You really have to consider these things when undertaking a problem of such magnitude.

* * *

Our everready friend Mr. Webster defines the slide rule as follows:

Slide:—derived from the Egyptian Cleopatra, meaning to slip—to glide—to pass smoothly.

Rule—(Ancient Hebrew) an instrument, a rude process of operation. Hence slide rule: an instrument used to pass a course smoothly by a rude process.

A slide rule is something like a woman. It is slippery and no one ever learns to manage one. It has a variety of figures which are more or less true. Men go crazy to get one and then wish they had saved their money.

—*Iowa Engineer*

* * *

Incidently, we have recently discovered that, in all probability we have been holding back the development of engineering construction for the entire city of Ithaca. Recently unearthed in a drawer were seven blueprints giving detailed plans for the construction of the Barge Canal Harbor Dam. Now provided with detailed drawings of main trusses, sector gates 3 and 4, hinge assemblies, lower chord lateral bracings, and breast wall plates and prop mechanisms, we need only a couple of nice, big steel girders and two or three dozen rivets (faculty adviser's note; a more specific bill of materials is greatly to be desired) in order to become dam constructors on a large scale.

The Technical School Prepares for Industrial Marketing

(*Continued from page thirty-two*)

and dies are investments in products. Just as there are appropriate tools for the several processes of production, so there are advertising tools for the various needs of selling.

The Competitive Survey

Now, let us refer back to the diagram again. You should note carefully the competitive product survey. It is important in that the things it brings to light are so frequently overlooked. As you know, in athletics—football, baseball, track, etc.—we study the opposing teams in an endeavor to discover their strong and weak points, to get a line on their star performers, and to evaluate their strategies and techniques. In a manner quite similar, a business organization should take every measure to keep constantly informed concerning its competitors.

Illustrative of this point is a case cited by Mr. Bernard Lester of the Westinghouse Electric and Manufacturing Company in the May 1937 issue of *Industrial Marketing*. It seems that several years ago a manufacturer found that his advertising in various business and industrial magazines was not registering. Checks of various sorts were resorted to but the results were invariably negative. The sales manager then clipped the advertisements of each competitor from the leading magazines for a period of two years. These he put on display in his office, side by side, with his own advertisements.

The comparison between the two types of advertising was so striking that the weakness of the story told by the advertisements of our manufacturer was soon revealed. He had devoted his space to advertising product characteristics, instead of telling his prospective customers how his product would help them to reduce costs and to make more money. He had visualized his product rather than the use to which the customers might put the product. The advertising manager saw the light, and a new advertising policy was adopted. The lessons learned by this company are typical of the benefits that accrue from competitive product surveys.

I know you are all fully cognizant that lower production costs have come through the intelligent choice of products, sound organization, reasonable volume and the proper selection and use of modern production tools. I believe the future will find you equally aware of the fact that lower sales costs can be achieved through the intelligent choice of markets, sound sales organization, and the proper selection and use of modern selling tools. Herein are represented many of the present and future activities of engineers.

COLLEGE NOTES

(*Continued from page forty-six*)

Stresses in Gear Teeth by the Photoelastic Method," prepared in consultation with Professors H. F. Moore and F. B. Seely.

Instructor Millard V. Barton is the other new man in the Department of Machine Design. He received the Degree of B.S. in M.E. from California Institute of Technology in 1932, and the Degree of M.S. in C.E. from the University of Colorado in 1937. From 1934-1937 he was with the U. S. Bureau of Reclamation, working on the design of gates and valves for Boulder, Coulee, and other dams, and on hoisting mechanisms, indicators and controls, and penstock piping, the work including mathematical stress analysis, photoelastic investigations, and testing. He is author and joint author of several of the Technical Memoranda issued by the Bureau of Reclamation.

In the Department of Experimental Engineering, three new instructors have been appointed this year. Mr. Frederick S. Erdman has accepted an instructorship in this department while working for a Doctor's Degree. He graduated from Princeton in 1924 with the B.S. Degree. After teaching at the American University in Beirut, he entered the Massachusetts Institute of Technology from which he received the B.S. in M.E. Degree in 1927. After working with the Worthington Pump and Machinery Corporation in Cincinnati, he joined the teaching staff of the Engineering School of Robert College in Istanbul, Turkey, where he held an Assistant Professorship for eight years. Last year, he entered the Cornell Graduate School and held the Sibley Fellowship.

Instructor Bartholomew J. Conta, also in the Department of Experimental Engineering, graduated from the University of Rochester in 1936 with the Degree of Bachelor of Science in Mechanical Engineering. Last year he came to Cornell as a candidate for the Degree of M.S. in Engineering and held a John McMullen Research Scholarship while working on a Westinghouse Research Project.

Mr. William P. Bebbington is the third new instructor in the Department of Experimental Engineering. He completed the four-year course in Chemistry at Cornell, receiving the Degree of B. Chem. in 1936. He then entered the Graduate School to work for the Doctor's Degree and served as assistant under Dr. Rhodes in Chemical Engineering. He has spent his summers with the Ingersoll Rand Company at Painted Post, and in the Technical Service Division of the Standard Oil Company at Cleveland.

FACULTY CHANGES IN E.E.

In the Electrical Engineering Department, E. R. Paige, formerly instructor in E. Theory, has resigned to take a position with the Niagara and Hudson Company at Buffalo as head of the company's technical school. D. Ramadanoff, formerly instructor in E. Theory, has taken a position in the research department of the National Carbon Company in Cleveland. Their places will be taken by Howard G. Smith, E.E. '30 and E. W. Manning, instructor in Senior E. Lab.

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TAU BETA PI ELECTS

At a meeting on Tuesday, November 9, Tau Beta Pi elected the following fifteen men: R. N. Ali (C.E.), Nicol Bissell (Arch.), C. H. Dawson (E.E.), J. W. Gaul (C.E.), R. H. Hemmerich (Chem.), J. C. Lawrence (Arch.), J. H. McClennan (A.E.E.E.), J. E. Mitchell (A.E.), D. F. Sanders (E.E.), J. A. Smith (E.E.), R. H. Stephens (Chem.), M. W. Stoffle (Arch.), and Freeman Svenningson (M.E.), all of the class of '38; and A. R. Davis (A.E.), and K. J. Nelson (Chem.) of the class of '39.

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E. E. SMOKER

With Psi Upsilon as host, the Student-Faculty E.E. Smoker was held on the evening of October 20. Members of the sophomore, junior and senior classes cast class consciousness aside for the nonce and enjoyed the talks which Director Lincoln and various seniors presented for their edification and amusement. Followed color movies of an extensive vacation trip taken by Mr. Wood, instructor in E.E. Also followed cider and doughnuts. General chairman of the committee was Howie North, '38.

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SOCIETIES HOLD COMBINED MEETING

The American Institute of Electrical Engineers, in combination with the A.S.M.E. and the A.S.C.E. presented an address by Mr. G. F. Dodge on the evening of October 22. The meeting, the first of series to be held during the current school year, was held in Franklin Hall. Mr. Dodge, who has been actively associated with construction of Grand Coulee Dam, discussed the construction and use of certain equipment used in the building of the dam. His talk included the presentation of cost and size data of various machinery used and moving pictures of the apparatus in operation.

ALUMNI NOTES

H. W. FISHER DIES

Originator of various innovations in cable construction and measurement, Henry Wright Fisher, EE '88 died October 7th at Asheville, N. C. Born in Youghal, Ireland, in 1861, Mr. Fisher came to the United States in 1874 from Argentina. A member of Sigma Xi, he went with the Standard Underground Cable Co. in 1889 as chief electrical engineer, retiring in 1930. He became successively, manager of the lead and cable works, and technical director and consulting engineer. Mr. Fisher served on various committees of the American Institute of Electrical Engineers and was made a life member. In 1901 he was elected president of the Engineers Society of Western Pennsylvania. Member of numerous engineering societies, he attended a secret conference during the World War at which Admiral Sims outlined the Naval policy before fifty of the prominent engineers of the country. He leaves his wife, Harriette Prentice Wixom, and two sons, Kenneth D., ex '16, and Leicester W., '18.

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BERNA APPOINTED GENERAL MANAGER

For the last six years General Sales Manager of the National Acme Co., Cleveland, Tell Berna, ME '12, has been appointed general manager of the National Machine Tool Builders' Association of Cleveland. Mr. Berna was formerly manager of the Cincinnati office of Cutler-Hammer, Inc., and later sales manager of the G. A. Gray Company and the Union Twist Drill Co.

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FORMER EDITOR MARRIES

Mr. and Mrs. A. S. Dewing have announced the marriage of their daughter, Abigail Starr to, of all people, Mr. Stuart Benjamin Avery, C.E. '32, former Editor-in-Chief of our worthy predecessor, the Cornell Civil Engineer. The bridge and groom are reported at home in Denver, Colo.

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APPOINTED MEMBER TRADE COMMISSION

A. Manuel Fox, '11 CE, former Director of Research for the Federal Tariff Commission, took office July 26 as a Commissioner under an appointment by President Roosevelt. A member of the commission staff since 1923, he has been in charge of the economics staff since 1924. During 1930 and 1934, he acted as leading tariff adviser to the Ways and Means Committee of the House and the Finance Committee of the Senate.

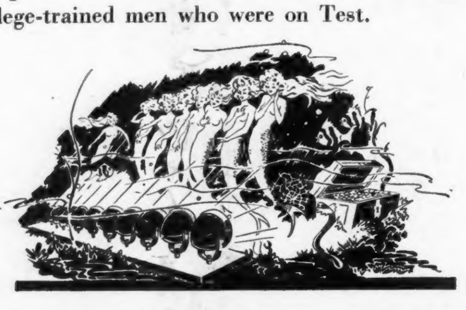
G-E *Campus* N*ews*

A 40-MILE-AN-HOUR MINE HOIST

The problem of hauling a 25-ton load up a steep mine shaft at a speed of 3,600 feet per minute, or approximately 41 miles an hour, was recently undertaken by the General Electric Company for a Southeastern coal company. Upon completion, this mine hoist will be the largest and fastest in this country.

More than 6000 feet of wire rope wound around an 18-foot drum will hoist an unbalanced load of 50,800 pounds to the surface. The driving power for this tremendous weight will be a 2500-hp G-E hoist motor with dynamic braking as a safety factor to reduce the speed when men are being carried.

For the last 40 years the General Electric Company has been engaged in the manufacture of electric mining equipment. Much of the new design and development in this field has been contributed by college-trained men who were on Test.



FLOODLIGHTING DAVY JONES' LOCKER

When Capt. John D. Craig, deep-sea diver and photographer, descends to the black depths of the Irish Channel to photograph the salvage operations of the Lusitania, Davy Jones' Locker will be floodlighted for the first time in history.

The hulk of the ill-fated Lusitania lies buried in shifting sand at a depth of approximately 300 feet, with a treasure in her coffers valued at between $4,000,000 and $15,000,000. To illuminate the wreck for filming, the General Electric Laboratories in Nela Park, Cleveland, Ohio developed a 5000-watt lamp, built to withstand a pressure of 500 pounds to the square inch—more than three times the pressure believed to be around the vessel. Capt. Craig will use a battery of 12 of these lamps mounted on a submarine stage to floodlight the inky depths.

So widespread are the uses of electricity that the development of an underwater lamp merely illustrates the problems encountered by G-E engineers. Many of these men were on the college campus but a few years ago.

MODERN LILLIPUT

Wire, three thousandths of an inch in diameter, flattened between two polished rollers to a thickness of nine ten-thousandths of an inch; pivots ground to a point and then rounded to a radius half the diameter of a human hair, yet still sharper than the sharpest needle; sapphires not as large as the head of a pin. Such Lilliputian parts are to be found in the West Lynn plant of the General Electric Company.

A pivot with a point two thousandths of an inch in diameter, yet it supports a pressure of many thousands of pounds to the square inch. Hundreds of such parts are assembled to produce instruments—instruments that measure small flows of current, great flows of current, light, sound, vibration, strain, and time. These instruments are so sensitive that they measure the smallest quantities, yet sturdy enough to withstand the severe vibrations of a locomotive cab or an airplane dashboard.

The design and manufacture of precision instruments is but one of the many fields which are open to technically trained men in the General Electric Company.

GENERAL ELECTRIC

90-15DH